

1 CLAIMS:

2 What is claimed is:

1 1. A method for forming a dielectric layer comprising:
2 depositing a dielectric precursor solution onto a surface of a substrate;
3 spinning the substrate to spread the dielectric precursor solution over the surface
4 of the substrate;
5 introducing a catalyst through a filter, wherein the filter causes a substantially
6 homogenous distribution of the catalyst within the dielectric precursor solution, wherein a
7 dielectric layer forms containing pores and wherein a solvent is contained in the pores;
8 and
9 drying the dielectric layer using a carrier gas after introducing the catalyst,
10 wherein the carrier gas places a positive pressure within the pores while removing the
11 solvent to form a low-k dielectric layer.

1 2. The method of claim 1, wherein the ratio of carrier gas includes a vapor and an
2 inert gas and the ratio of the inert gas to vapor is changed to increase an amount of inert
3 gas to maintain a constant capillary pressure within the pores.

1 3. The method of claim 1 further comprising:
2 annealing the substrate after drying the solution.

1 4. The method of claim 1, wherein the catalyst is an acid catalyst.

1 5. The method of claim 4, wherein the acid catalyst is chosen from a group of HCL
2 and HNO₃.

1 6. The method of claim 1, wherein the catalyst is a base catalyst.

- 1 7. The method of claim 6, wherein the base catalyst is ammonium fluoride.
- 1 8. The method of claim 1, wherein the dielectric precursor solution is $\text{Si}(\text{OR})_4$,
2 wherein R is a solvent.
- 1 9. The method of claim 8, wherein R is selected from a group of ethanol and
2 methanol.
- 1 10. The method of claim 1, wherein the dielectric layer is an aerogel dielectric layer.
- 1 11. The method of claim 1, wherein the catalyst is introduced through a filter made of
2 a mesh vapor distribution unit.
- 1 12. The method of claim 1, wherein the pores have a range in size from about 0.1
2 microns to about 1.0 microns.
- 1 13. The method of claim 1, wherein the catalyst is an anhydrous HF.
- 1 14. The method of claim 1, wherein the substrate is a semiconductor substrate.
- 1 15. The method of claim 1, wherein the substrate is a silicon substrate.
- 1 16. The method of claim 1, wherein the substrate is a germanium substrate.
- 1 17. A method for forming a silicon dioxide layer in a single processing apparatus
2 comprising:
3 depositing a silica precursor solution onto a surface of a substrate;

4 spinning the substrate to spread the solution over the surface of the substrate;
5 introducing a catalyst through a filter, wherein the filter causes a substantially
6 homogenous distribution of the catalyst within the substrate, wherein a dielectric layer
7 forms containing pores.

1 18. The method of claim 17, wherein a solvent is contained in the pores and further
2 comprising:

3 drying the silica precursor solution to form the silicon dioxide layer using a carrier
4 gas after introducing the catalyst, wherein the carrier gas places a positive pressure within
5 the pores while removing the solvent to form a low-k dielectric layer.

1 19. The method of claim 17, wherein the catalyst is an acid catalyst.

1 20. The method of claim 19, wherein the acid catalyst is chosen from a group of HCL
2 and HNO₃.

1 21. The method of claim 17, wherein the catalyst is a base catalyst.

1 22. The method of claim 21, wherein the base catalyst is ammonium fluoride.

1 23. The method of claim 17, wherein the silica precursor is Si(OR)₄, wherein R is a
2 solvent.

1 24. The method of claim 23, wherein R is selected from a group of ethanol and
2 methanol.

1 25. The method of claim 17, wherein the dielectric layer is an aerogel dielectric
2 layer.

1 26. An apparatus comprising:
 2 a housing;
 3 an opening in the housing configured to pass a substrate into the housing;
 4 a chuck located within the housing, wherein the chuck is configured to hold the
 5 substrate for processing and wherein the substrate may be spun using the chuck;
 6 an inlet within the housing, wherein the inlet is configured for connection to a
 7 source for a precursor silica solution and wherein the inlet is configured to deposit the
 8 precursor silica solution onto the substrate held by the chuck and wherein a film of the
 9 precursor solution may be formed on the substrate; and
 10 a filter unit, wherein the filter unit is configured to receive a catalyst and introduce
 11 the catalyst onto the wafer in a uniform manner such that the catalyst becomes
 12 homogeneously diffused into the film.

1 27. The apparatus of claim 26, wherein the substrate is a semiconductor wafer.

1 28. The apparatus of claim 26, wherein the substrate is a substrate for an integrated
 2 circuit.

1 29. The apparatus of claim 26, wherein the substrate is a substrate for a chemical
 2 sensor.

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